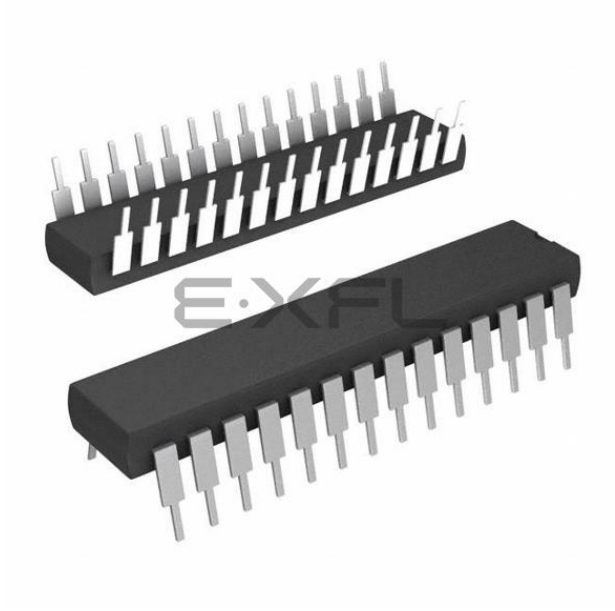

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Details	
Product Status	Active
Core Processor	PIC
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	25
Program Memory Size	14KB (8K x 14)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	512 x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 17x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Through Hole
Package / Case	28-DIP (0.300", 7.62mm)
Supplier Device Package	28-SPDIP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/pic16lf1516-i-sp

TABLE 1-2: PINOUT DESCRIPTION

Name	Function	Input Type	Output Type	Description
RA0/AN0/$\overline{SS}$(2)	RA0	TTL	CMOS	General purpose I/O.
	AN0	AN	—	ADC Channel 0 input.
	$\overline{SS}$	ST	—	Slave Select input.
RA1/AN1	RA1	TTL	CMOS	General purpose I/O.
	AN1	AN	—	ADC Channel 1 input.
RA2/AN2	RA2	TTL	CMOS	General purpose I/O.
	AN2	AN	—	ADC Channel 2 input.
RA3/AN3/VREF+	RA3	TTL	CMOS	General purpose I/O.
	AN3	AN	—	ADC Channel 3 input.
	VREF+	AN	—	ADC Positive Voltage Reference input.
RA4/T0CKI	RA4	TTL	CMOS	General purpose I/O.
	T0CKI	ST	—	Timer0 clock input.
RA5/AN4/$\overline{SS}$(1)/VCAP	RA5	TTL	CMOS	General purpose I/O.
	AN4	AN	—	ADC Channel 4 input.
	$\overline{SS}$	ST	—	Slave Select input.
	VCAP	Power	Power	Filter capacitor for Voltage Regulator (PIC16F1516/7/8/9 only).
RA6/OSC2/CLKOUT	RA6	TTL	CMOS	General purpose I/O.
	OSC2	—	XTAL	Crystal/Resonator (LP, XT, HS modes).
	CLKOUT	—	CMOS	FOSC/4 output.
RA7/OSC1/CLKIN	RA7	TTL	CMOS	General purpose I/O.
	OSC1	XTAL	—	Crystal/Resonator (LP, XT, HS modes).
	CLKIN	ST	—	External clock input (EC mode).
RB0/AN12/INT	RB0	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN12	AN	—	ADC Channel 12 input.
	INT	ST	—	External interrupt.
RB1/AN10	RB1	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN10	AN	—	ADC Channel 10 input.
RB2/AN8	RB2	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN8	AN	—	ADC Channel 8 input.
RB3/AN9/CCP2(2)	RB3	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN9	AN	—	ADC Channel 9 input.
	CCP2	ST	CMOS	Capture/Compare/PWM 2.
RB4/AN11	RB4	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN11	AN	—	ADC Channel 11 input.
RB5/AN13/T1G	RB5	TTL	CMOS	General purpose I/O with IOC and WPU.
	AN13	AN	—	ADC Channel 13 input.
	T1G	ST	—	Timer1 Gate input.
RB6/ICSPCLK	RB6	TTL	CMOS	General purpose I/O with IOC and WPU.
	ICSPCLK	ST	CMOS	In-Circuit Data I/O.
RB7/ICSPDAT	RB7	TTL	CMOS	General purpose I/O with IOC and WPU.
	ICSPDAT	ST	CMOS	ICSP™ Data I/O.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open-Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels I^2C = Schmitt Trigger input with I^2C levels
HV = High Voltage XTAL = Crystal

Note 1: Peripheral pin location selected using APFCON register (Register 12-1). Default location.
2: Peripheral pin location selected using APFCON register (Register 12-1). Alternate location.
3: PORTD and RE<2:0> available on PIC16(L)F1517/9 only.

3.4.5 CORE FUNCTION REGISTERS SUMMARY

The Core Function registers listed in Table 3-7 can be addressed from any Bank.

TABLE 3-7: CORE FUNCTION REGISTERS SUMMARY

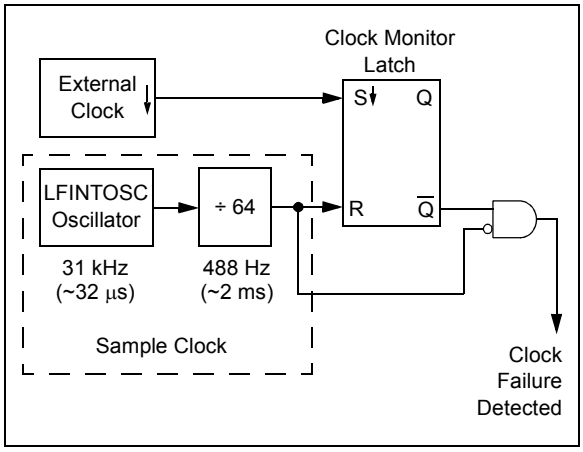
Addr	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value on POR, BOR	Value on all other Resets
Bank 0-31											
x00h or x80h	INDF0	Addressing this location uses contents of FSR0H/FSR0L to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
x01h or x81h	INDF1	Addressing this location uses contents of FSR1H/FSR1L to address data memory (not a physical register)								xxxx xxxx	uuuu uuuu
x02h or x82h	PCL	Program Counter (PC) Least Significant Byte								0000 0000	0000 0000
x03h or x83h	STATUS	—	—	—	$\overline{TO}$	$\overline{PD}$	Z	DC	C	---1 1000	---q quuu
x04h or x84h	FSR0L	Indirect Data Memory Address 0 Low Pointer								0000 0000	uuuu uuuu
x05h or x85h	FSR0H	Indirect Data Memory Address 0 High Pointer								0000 0000	0000 0000
x06h or x86h	FSR1L	Indirect Data Memory Address 1 Low Pointer								0000 0000	uuuu uuuu
x07h or x87h	FSR1H	Indirect Data Memory Address 1 High Pointer								0000 0000	0000 0000
x08h or x88h	BSR	—	—	—	BSR4	BSR3	BSR2	BSR1	BSR0	---0 0000	---0 0000
x09h or x89h	WREG	Working Register								0000 0000	uuuu uuuu
x0Ah or x8Ah	PCLATH	—	Write Buffer for the upper 7 bits of the Program Counter							-000 0000	-000 0000
x0Bh or x8Bh	INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	0000 0000	0000 0000

Legend: x = unknown, u = unchanged, q = value depends on condition, - = unimplemented, read as '0', r = reserved. Shaded locations are unimplemented, read as '0'.

5.5 Fail-Safe Clock Monitor

The Fail-Safe Clock Monitor (FSCM) allows the device to continue operating should the external oscillator fail. The FSCM can detect oscillator failure any time after the Oscillator Start-up Timer (OST) has expired. The FSCM is enabled by setting the FCMEN bit in the Configuration Words. The FSCM is applicable to all external Oscillator modes (LP, XT, HS, EC, RC and secondary oscillator).

FIGURE 5-9: FSCM BLOCK DIAGRAM



5.5.1 FAIL-SAFE DETECTION

The FSCM module detects a failed oscillator by comparing the external oscillator to the FSCM sample clock. The sample clock is generated by dividing the LFINTOSC by 64 (see Figure 5-9). Inside the fail detector block is a latch. The external clock sets the latch on each falling edge of the external clock. The sample clock clears the latch on each rising edge of the sample clock. A failure is detected when an entire half-cycle of the sample clock elapses before the external clock goes low.

5.5.2 FAIL-SAFE OPERATION

When the external clock fails, the FSCM switches the device clock to an internal clock source and sets the bit flag OSFIF of the PIR2 register. Setting this flag will generate an interrupt if the OSFIE bit of the PIE2 register is also set. The device firmware can then take steps to mitigate the problems that may arise from a failed clock. The system clock will continue to be sourced from the internal clock source until the device firmware successfully restarts the external oscillator and switches back to external operation.

The internal clock source chosen by the FSCM is determined by the IRCF<3:0> bits of the OSCCON register. This allows the internal oscillator to be configured before a failure occurs.

5.5.3 FAIL-SAFE CONDITION CLEARING

The Fail-Safe condition is cleared after a Reset, executing a SLEEP instruction or changing the SCS bits of the OSCCON register. When the SCS bits are changed, the OST is restarted. While the OST is running, the device continues to operate from the INTOSC selected in OSCCON. When the OST times out, the Fail-Safe condition is cleared after successfully switching to the external clock source. The OSFIF bit should be cleared prior to switching to the external clock source. If the Fail-Safe condition still exists, the OSFIF flag will again become set by hardware.

5.5.4 RESET OR WAKE-UP FROM SLEEP

The FSCM is designed to detect an oscillator failure after the Oscillator Start-up Timer (OST) has expired. The OST is used after waking up from Sleep and after any type of Reset. The OST is not used with the EC or RC Clock modes so that the FSCM will be active as soon as the Reset or wake-up has completed. When the FSCM is enabled, the Two-Speed Start-up is also enabled. Therefore, the device will always be executing code while the OST is operating.

Note:	Due to the wide range of oscillator start-up times, the Fail-Safe circuit is not active during oscillator start-up (i.e., after exiting Reset or Sleep). After an appropriate amount of time, the user should check the Status bits in the OSCSTAT register to verify the oscillator start-up and that the system clock switchover has successfully completed.

REGISTER 7-5: PIR2: PERIPHERAL INTERRUPT REQUEST REGISTER 2

R/W-0/0	U-0	U-0	U-0	R/W-0/0	U-0	U-0	R/W-0/0
OSFIF	—	—	—	BCLIF	—	—	CCP2IF
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
u = Bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	

bit 7 **OSFIF:** Oscillator Fail Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 6-4 **Unimplemented:** Read as '0'

bit 3 **BCLIF:** MSSP Bus Collision Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

bit 2-1 **Unimplemented:** Read as '0'

bit 0 **CCP2IF:** CCP2 Interrupt Flag bit
1 = Interrupt is pending
0 = Interrupt is not pending

Note: Interrupt flag bits are set when an interrupt condition occurs, regardless of the state of its corresponding enable bit or the Global Enable bit, GIE, of the INTCON register. User software should ensure the appropriate interrupt flag bits are clear prior to enabling an interrupt.

TABLE 7-1: SUMMARY OF REGISTERS ASSOCIATED WITH INTERRUPTS

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register on Page
INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	74
OPTION_REG	$\overline{\text{WPUEN}}$	INTEDG	TMR0CS	TMR0SE	PSA	PS<2:0>			146
PIE1	TMR1GIE	ADIE	RCIE	TXIE	SSPIE	CCP1IE	TMR2IE	TMR1IE	75
PIE2	OSFIE	—	—	—	BCLIE	—	—	CCP2IE	76
PIR1	TMR1GIF	ADIF	RCIF	TXIF	SSPIF	CCP1IF	TMR2IF	TMR1IF	77
PIR2	OSFIF	—	—	—	BCLIF	—	—	CCP2IF	78

Legend: — = unimplemented locations read as '0'. Shaded cells are not used by Interrupts.

TABLE 11-1: FLASH MEMORY ORGANIZATION BY DEVICE

Device	Row Erase (words)	Write Latches (words)
PIC16(L)F1516	32	32
PIC16(L)F1517		
PIC16(L)F1518		
PIC16(L)F1519		

11.2.1 READING THE FLASH PROGRAM MEMORY

To read a program memory location, the user must:

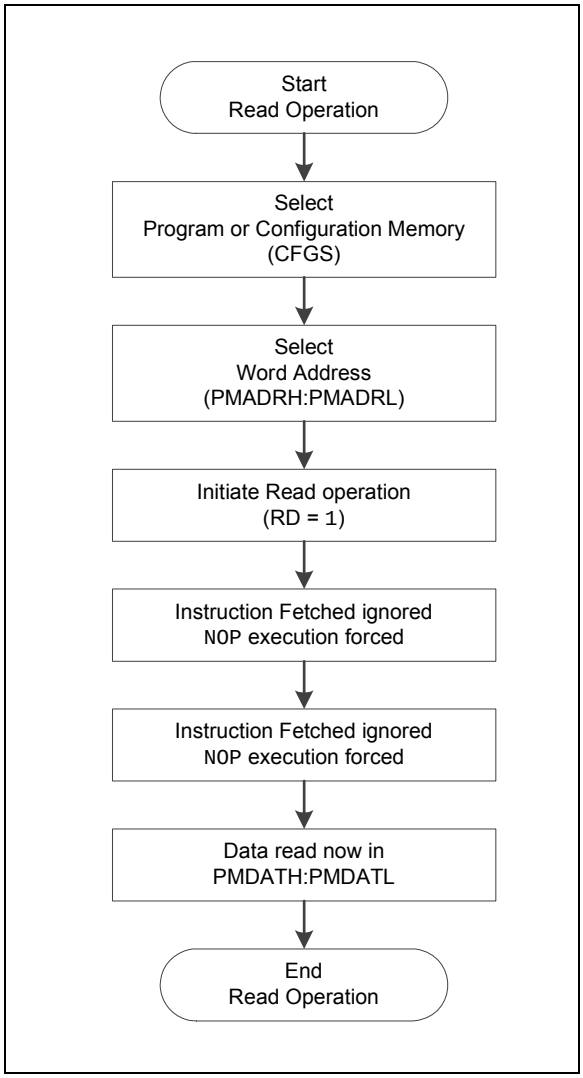
1. Write the desired address to the PMADRH:PMADRL register pair.
2. Clear the CFGS bit of the PMCON1 register.
3. Then, set control bit RD of the PMCON1 register.

Once the read control bit is set, the program memory Flash controller will use the second instruction cycle to read the data. This causes the second instruction immediately following the "`BSF PMCON1,RD`" instruction to be ignored. The data is available in the very next cycle, in the PMDATH:PMDATL register pair; therefore, it can be read as two bytes in the following instructions.

PMDATH:PMDATL register pair will hold this value until another read or until it is written to by the user.

Note:	The two instructions following a program memory read are required to be `NOP`s. This prevents the user from executing a 2-cycle instruction on the next instruction after the RD bit is set.

FIGURE 11-1: FLASH PROGRAM MEMORY READ FLOWCHART



REGISTER 11-6: PMCON1: PROGRAM MEMORY CONTROL 1 REGISTER

U-1	R/W-0/0	R/W-0/0	R/W/HC-0/0	R/W/HC-x/q[2]	R/W-0/0	R/S/HC-0/0	R/S/HC-0/0
—[1]	CFGS	LWLO	FREE	WRERR	WREN	WR	RD
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
S = Bit can only be set	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	HC = Bit is cleared by hardware

bit 7 **Unimplemented:** Read as '1'

bit 6 **CFGS:** Configuration Select bit
- 1 = Access Configuration, User ID and Device ID Registers
- 0 = Access Flash program memory

bit 5 **LWLO:** Load Write Latches Only bit[3]
- 1 = Only the addressed program memory write latch is loaded/updated on the next WR command
- 0 = The addressed program memory write latch is loaded/updated and a write of all program memory write latches will be initiated on the next WR command

bit 4 **FREE:** Program Flash Erase Enable bit
- 1 = Performs an erase operation on the next WR command (hardware cleared upon completion)
- 0 = Performs an write operation on the next WR command

bit 3 **WRERR:** Program/Erase Error Flag bit
- 1 = Condition indicates an improper program or erase sequence attempt or termination (bit is set automatically on any set attempt (write '1') of the WR bit).
- 0 = The program or erase operation completed normally.

bit 2 **WREN:** Program/Erase Enable bit
- 1 = Allows program/erase cycles
- 0 = Inhibits programming/erasing of program Flash

bit 1 **WR:** Write Control bit
- 1 = Initiates a program Flash program/erase operation.
  The operation is self-timed and the bit is cleared by hardware once operation is complete.
  The WR bit can only be set (not cleared) in software.
- 0 = Program/erase operation to the Flash is complete and inactive.

bit 0 **RD:** Read Control bit
- 1 = Initiates a program Flash read. Read takes one cycle. RD is cleared in hardware. The RD bit can only be set (not cleared) in software.
- 0 = Does not initiate a program Flash read.

Note 1: Unimplemented bit, read as '1'.
2: The WRERR bit is automatically set by hardware when a program memory write or erase operation is started (WR = 1) .
3: The LWLO bit is ignored during a program memory erase operation (FREE = 1).

REGISTER 12-19: PORTE: PORTE REGISTER

U-0	U-0	U-0	U-0	R-x/u	R/W-x/u	R/W-x/u	R/W-x/u
—	—	—	—	RE3	RE2(1)	RE1(1)	RE0(1)
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
u = Bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	

bit 7-4 **Unimplemented**: Read as '0'

bit 3-0 **RE<3:0>**: PORTE I/O Pin bits(1)
1 = Port pin is > VIH
0 = Port pin is < VIL

Note 1: RE<2:0> are not implemented on the PIC16(L)F1516/8. Read as '0'. Writes to RE<2:0> are actually written to corresponding LATE register. Reads from PORTE register is the return of actual I/O pin values.

REGISTER 12-20: TRISE: PORTE TRI-STATE REGISTER

U-0	U-0	U-0	U-0	U-1(2)	R/W-1	R/W-1	R/W-1
—	—	—	—	—	TRISE2(1)	TRISE1(1)	TRISE0(1)
bit 7							bit 0

Legend:		
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'
u = bit is unchanged	x = Bit is unknown	-n/n = Value at POR and BOR/Value at all other Resets
'1' = Bit is set	'0' = Bit is cleared	

bit 7-4 **Unimplemented**: Read as '0'

bit 3 **Unimplemented**: Read as '1'

bit 2-0 **TRISE<2:0>:** RE<2:0> Tri-State Control bits(1)
1 = PORTE pin configured as an input (tri-stated)
0 = PORTE pin configured as an output

Note 1: TRISE<2:0> are not implemented on the PIC16(L)F1517/9. Read as '0'.
2: Unimplemented, read as '1'.

TABLE 13-1: SUMMARY OF REGISTERS ASSOCIATED WITH INTERRUPT-ON-CHANGE

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register on Page
ANSELB	—	—	ANSB5	ANSB4	ANSB3	ANSB2	ANSB1	ANSB0	112
INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	74
IOCBF	IOCBP7	IOCBP6	IOCBP5	IOCBP4	IOCBP3	IOCBP2	IOCBP1	IOCBP0	125
IOCBN	IOCBN7	IOCBN6	IOCBN5	IOCBN4	IOCBN3	IOCBN2	IOCBN1	IOCBN0	125
IOCBP	IOCBF7	IOCBF6	IOCBF5	IOCBF4	IOCBF3	IOCBF2	IOCBF1	IOCBF0	125
TRISB	TRISB7	TRISB6	TRISB5	TRISB4	TRISB3	TRISB2	TRISB1	TRISB0	111

Legend: — = unimplemented location, read as '0'. Shaded cells are not used by Interrupt-on-Change.

16.2 ADC Operation

16.2.1 STARTING A CONVERSION

To enable the ADC module, the ADON bit of the ADCON0 register must be set to a '1'. Setting the GO/$\overline{\text{DONE}}$ bit of the ADCON0 register to a '1' will start the Analog-to-Digital conversion.

Note:	The GO/$\overline{\text{DONE}}$ bit should not be set in the same instruction that turns on the ADC. Refer to **Section 16.2.6 "ADC Conversion Procedure"**.

16.2.2 COMPLETION OF A CONVERSION

When the conversion is complete, the ADC module will:

- Clear the GO/$\overline{\text{DONE}}$ bit
- Set the ADIF Interrupt Flag bit
- Update the ADRESH and ADRESL registers with new conversion result

16.2.3 TERMINATING A CONVERSION

If a conversion must be terminated before completion, the GO/$\overline{\text{DONE}}$ bit can be cleared in software. The ADRESH and ADRESL registers will be updated with the partially complete Analog-to-Digital conversion sample. Incomplete bits will match the last bit converted.

Note:	A device Reset forces all registers to their Reset state. Thus, the ADC module is turned off and any pending conversion is terminated.

16.2.4 ADC OPERATION DURING SLEEP

The ADC module can operate during Sleep. This requires the ADC clock source to be set to the FRC option. When the FRC oscillator source is selected, the ADC waits one additional instruction before starting the conversion. This allows the SLEEP instruction to be executed, which can reduce system noise during the conversion. If the ADC interrupt is enabled, the device will wake-up from Sleep when the conversion completes. If the ADC interrupt is disabled, the ADC module is turned off after the conversion completes, although the ADON bit remains set.

When the ADC clock source is something other than FRC, a SLEEP instruction causes the present conversion to be aborted and the ADC module is turned off, although the ADON bit remains set.

16.2.5 SPECIAL EVENT TRIGGER

The Special Event Trigger of the CCPx module allows periodic ADC measurements without software intervention. When this trigger occurs, the GO/$\overline{\text{DONE}}$ bit is set by hardware and the Timer1 counter resets to zero.

TABLE 16-2: SPECIAL EVENT TRIGGER

Device	CCP
PIC16(L)F1516	CCP2
PIC16(L)F1517	
PIC16(L)F1518	
PIC16(L)F1519	

Using the Special Event Trigger does not assure proper ADC timing. It is the user's responsibility to ensure that the ADC timing requirements are met.

Refer to **Section 20.0 "Capture/Compare/PWM Modules"** for more information.

FIGURE 21-9: SPI MODE WAVEFORM (SLAVE MODE WITH CKE = 0)

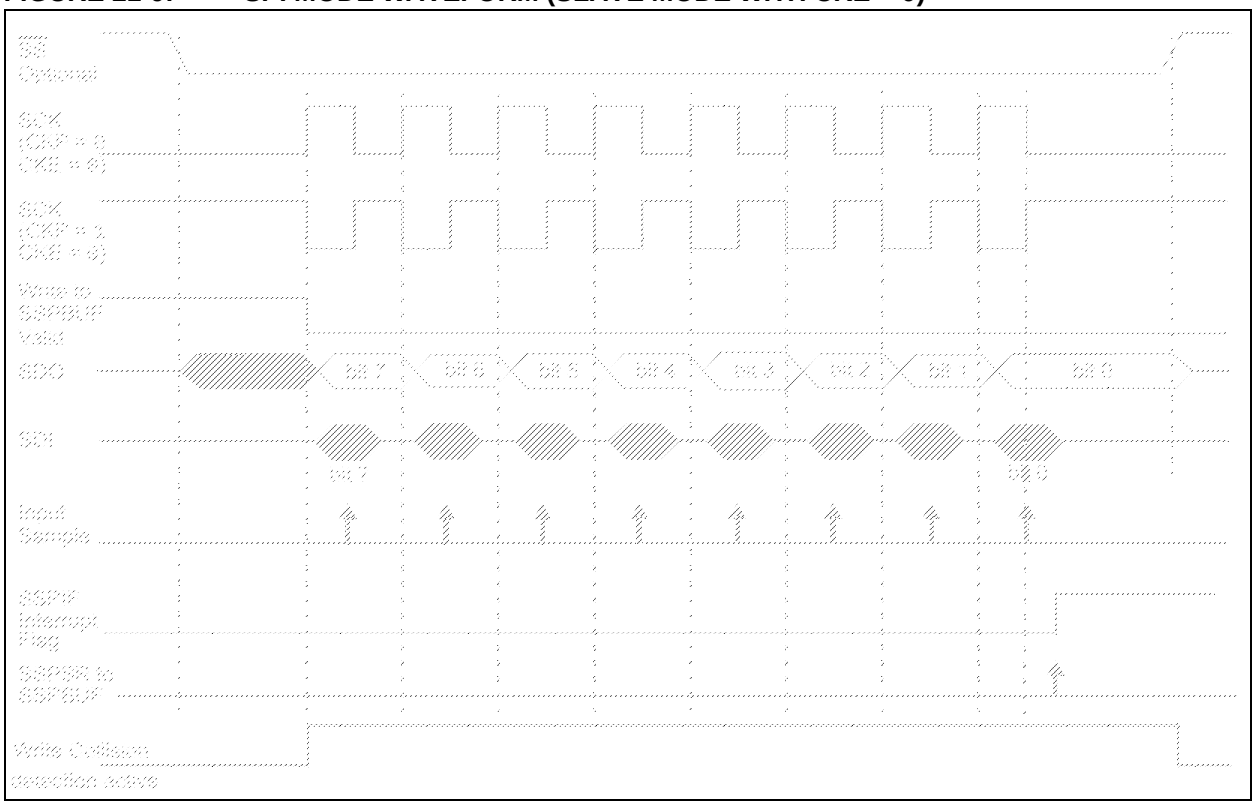
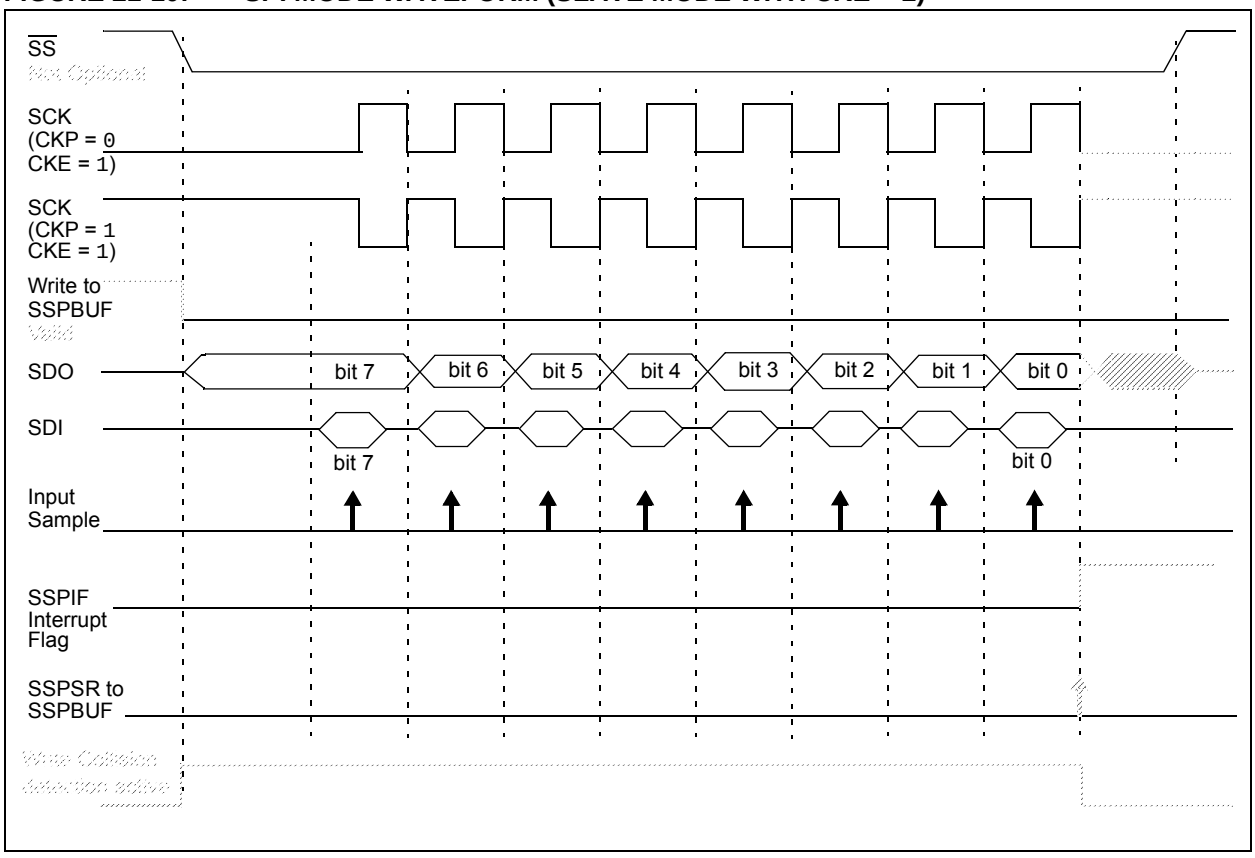


FIGURE 21-10: SPI MODE WAVEFORM (SLAVE MODE WITH CKE = 1)



21.6.13.2 Bus Collision During a Repeated Start Condition

During a Repeated Start condition, a bus collision occurs if:

a) A low level is sampled on SDA when SCL goes from low level to high level (Case 1).
b) SCL goes low before SDA is asserted low, indicating that another master is attempting to transmit a data '1' (Case 2).

When the user releases SDA and the pin is allowed to float high, the BRG is loaded with SSPADD and counts down to zero. The SCL pin is then deasserted and when sampled high, the SDA pin is sampled.

If SDA is low, a bus collision has occurred (i.e., another master is attempting to transmit a data '0', Figure 21-36. If SDA is sampled high, the BRG is reloaded and begins counting. If SDA goes from high-to-low before the BRG times out, no bus collision occurs because no two masters can assert SDA at exactly the same time.

If SCL goes from high-to-low before the BRG times out and SDA has not already been asserted, a bus collision occurs. In this case, another master is attempting to transmit a data '1' during the Repeated Start condition, see Figure 21-37.

If, at the end of the BRG time-out, both SCL and SDA are still high, the SDA pin is driven low and the BRG is reloaded and begins counting. At the end of the count, regardless of the status of the SCL pin, the SCL pin is driven low and the Repeated Start condition is complete.

FIGURE 21-36: BUS COLLISION DURING A REPEATED START CONDITION (CASE 1)

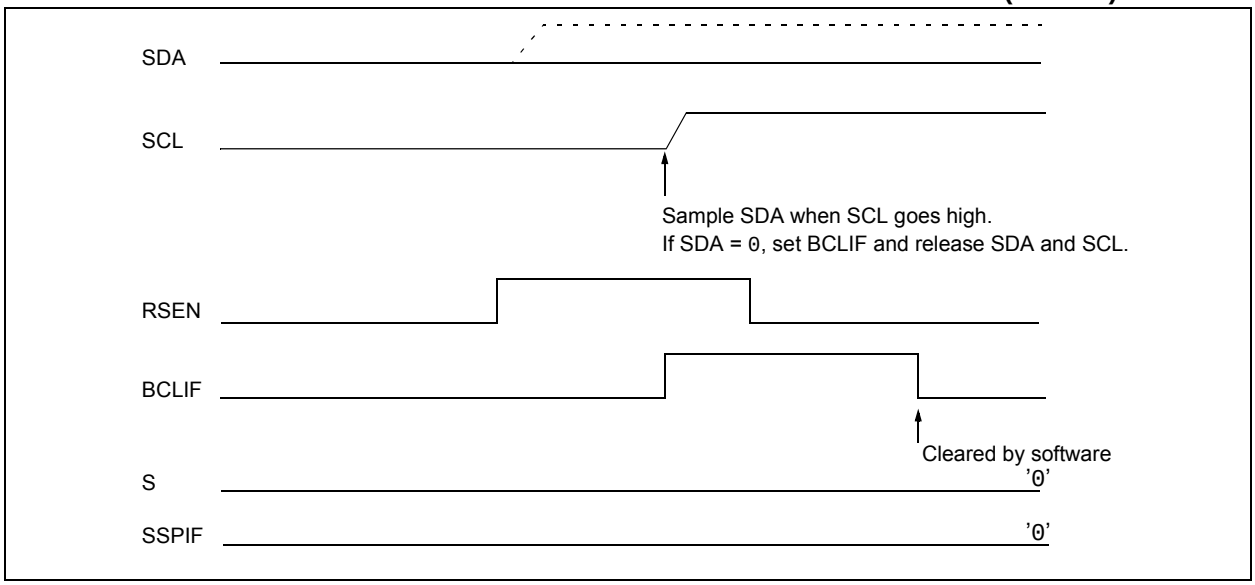


FIGURE 21-37: BUS COLLISION DURING REPEATED START CONDITION (CASE 2)

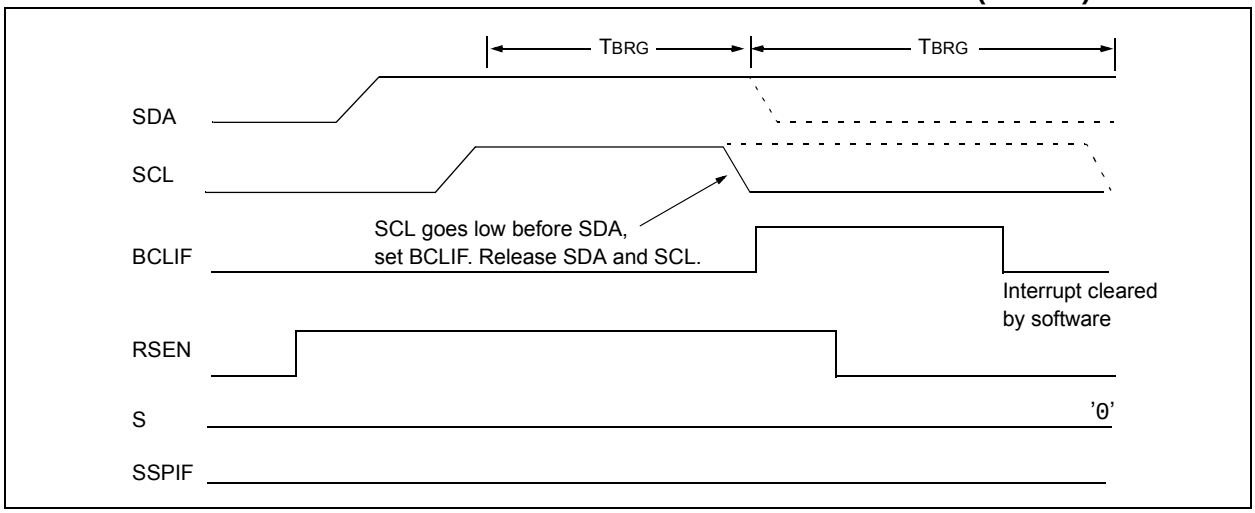
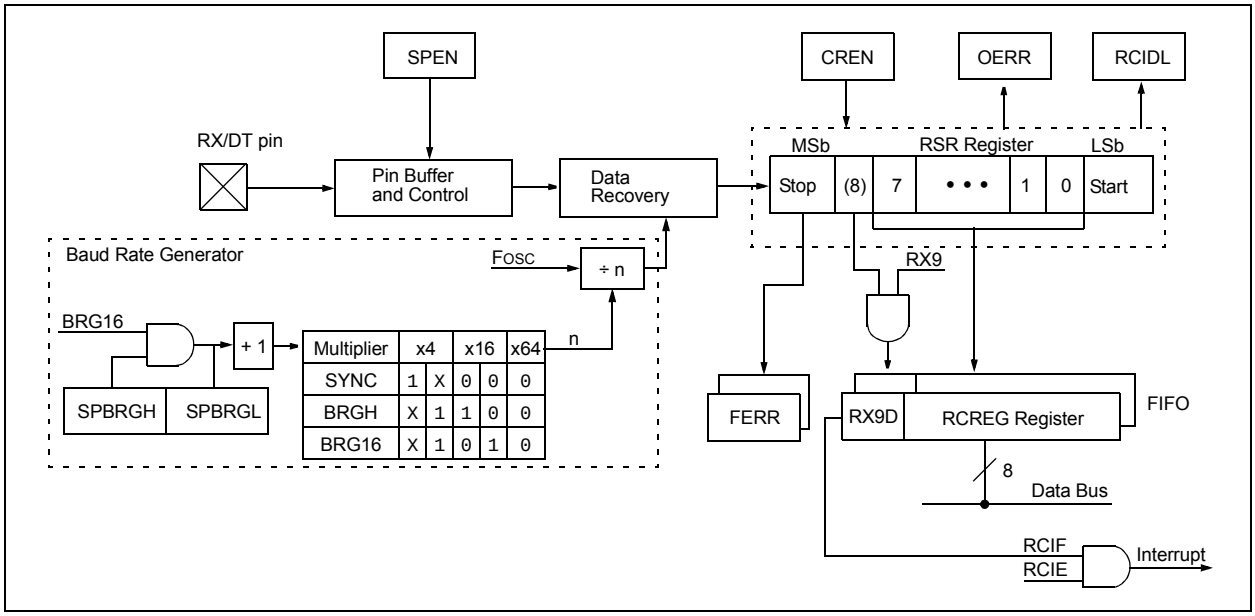


FIGURE 22-2: EUSART RECEIVE BLOCK DIAGRAM



The operation of the EUSART module is controlled through three registers:

- Transmit Status and Control (TXSTA)
- Receive Status and Control (RCSTA)
- Baud Rate Control (BAUDCON)

These registers are detailed in Register 22-1, Register 22-2 and Register 22-3, respectively.

When the receiver or transmitter section is not enabled then the corresponding RX or TX pin may be used for general purpose input and output.

22.1.1.5 TSR Status

The TRMT bit of the TXSTA register indicates the status of the TSR register. This is a read-only bit. The TRMT bit is set when the TSR register is empty and is cleared when a character is transferred to the TSR register from the TXREG. The TRMT bit remains clear until all bits have been shifted out of the TSR register. No interrupt logic is tied to this bit, so the user has to poll this bit to determine the TSR status.

Note:	The TSR register is not mapped in data memory, so it is not available to the user.

22.1.1.6 Transmitting 9-Bit Characters

The EUSART supports 9-bit character transmissions. When the TX9 bit of the TXSTA register is set, the EUSART will shift nine bits out for each character transmitted. The TX9D bit of the TXSTA register is the 9th, and Most Significant, data bit. When transmitting 9-bit data, the TX9D data bit must be written before writing the eight Least Significant bits into the TXREG. All nine bits of data will be transferred to the TSR shift register immediately after the TXREG is written.

A special 9-bit Address mode is available for use with multiple receivers. See **Section 22.1.2.7 "Address Detection"** for more information on the address mode.

22.1.1.7 Asynchronous Transmission Setup:

1. Initialize the SPBRGH, SPBRGL register pair and the BRGH and BRG16 bits to achieve the desired baud rate (see **Section 22.4 "EUSART Baud Rate Generator (BRG)"**).
2. Enable the asynchronous serial port by clearing the SYNC bit and setting the SPEN bit.
3. If 9-bit transmission is desired, set the TX9 control bit. A set 9th data bit will indicate that the eight Least Significant data bits are an address when the receiver is set for address detection.
4. Set SCKP bit if inverted transmit is desired.
5. Enable the transmission by setting the TXEN control bit. This will cause the TXIF interrupt bit to be set.
6. If interrupts are desired, set the TXIE interrupt enable bit of the PIE1 register. An interrupt will occur immediately provided that the GIE and PEIE bits of the INTCON register are also set.
7. If 9-bit transmission is selected, the 9th bit should be loaded into the TX9D data bit.
8. Load 8-bit data into the TXREG register. This will start the transmission.

FIGURE 22-3: ASYNCHRONOUS TRANSMISSION

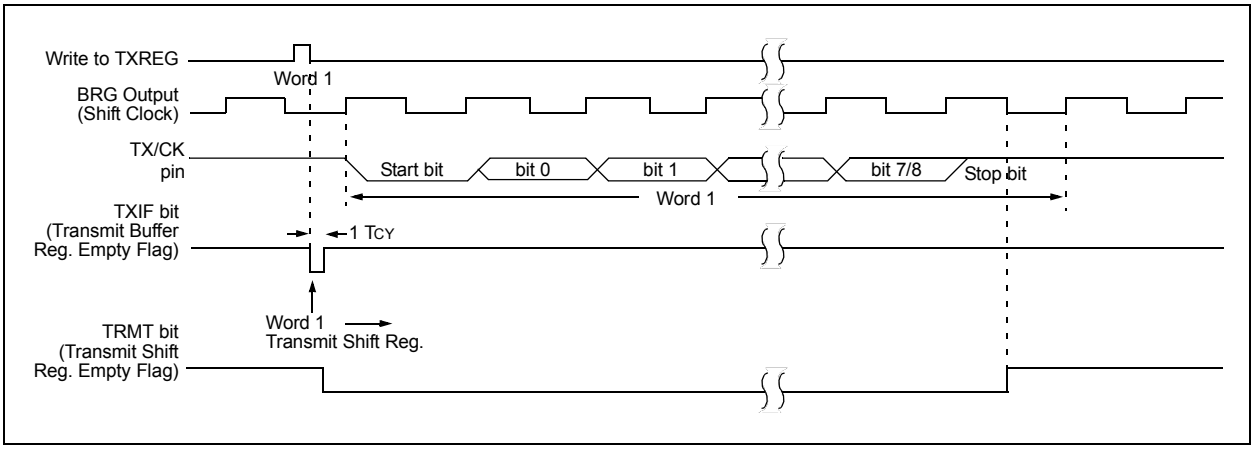
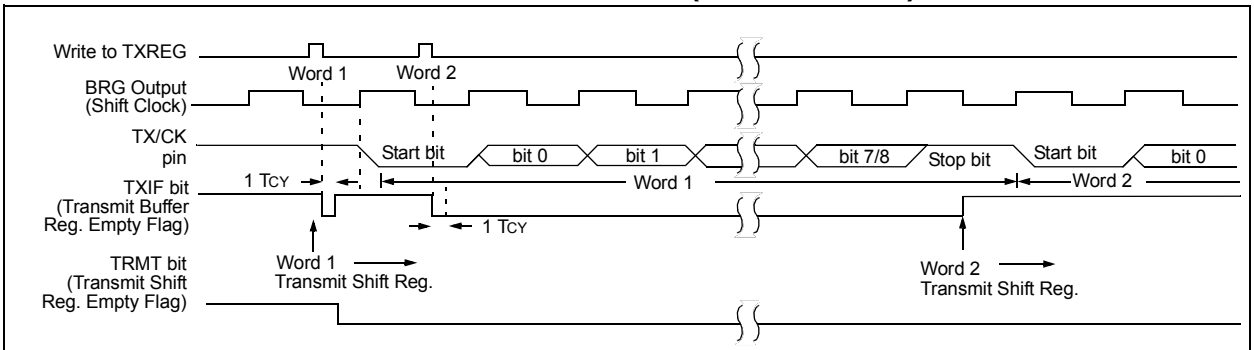
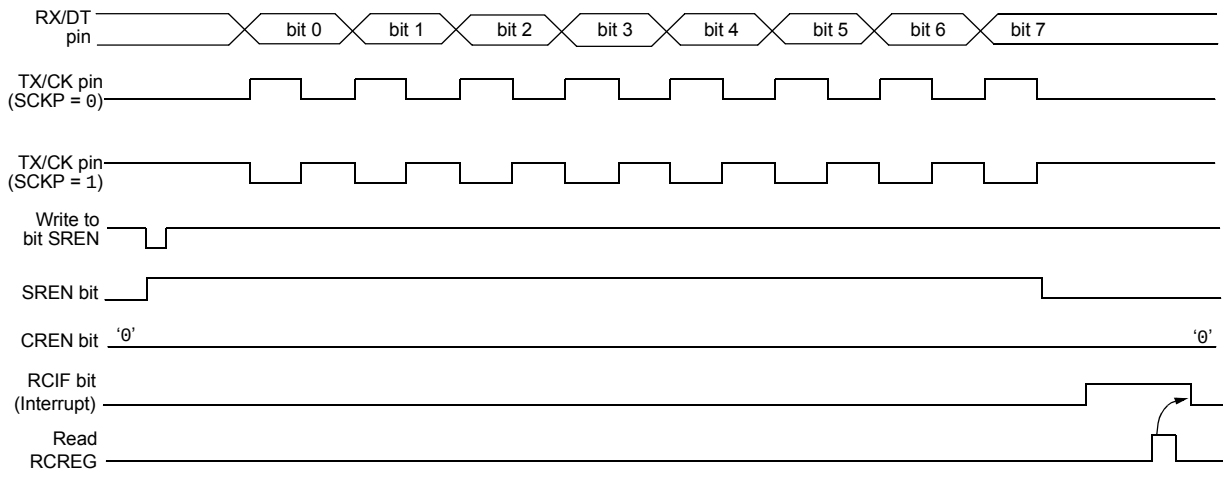


FIGURE 22-4: ASYNCHRONOUS TRANSMISSION (BACK-TO-BACK)



Note: This timing diagram shows two consecutive transmissions.

FIGURE 22-12: SYNCHRONOUS RECEPTION (MASTER MODE, SREN)



Note: Timing diagram demonstrates Sync Master mode with bit SREN = 1 and bit BRGH = 0.

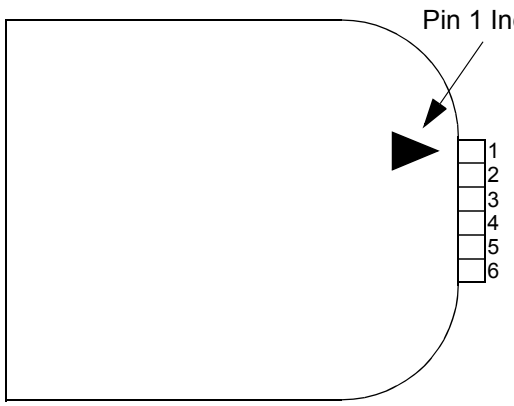
TABLE 22-6: SUMMARY OF REGISTERS ASSOCIATED WITH SYNCHRONOUS MASTER RECEPTION

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register on Page
BAUDCON	ABDOVF	RCIDL	—	SCKP	BRG16	—	WUE	ABDEN	232
INTCON	GIE	PEIE	TMR0IE	INTE	IOCIE	TMR0IF	INTF	IOCIF	74
PIE1	TMR1GIE	ADIE	RCIE	TXIE	SSPIE	CCP1IE	TMR2IE	TMR1IE	75
PIR1	TMR1GIF	ADIF	RCIF	TXIF	SSPIF	CCP1IF	TMR2IF	TMR1IF	77
RCREG	EUSART Receive Data Register								225*
RCSTA	SPEN	RX9	SREN	CREN	ADDEN	FERR	OERR	RX9D	231
SPBRGL	BRG<7:0>								233*
SPBRGH	BRG<15:8>								233*
TRISC	TRISC7	TRISC6	TRISC5	TRISC4	TRISC3	TRISC2	TRISC1	TRISC0	114
TXSTA	CSRC	TX9	TXEN	SYNC	SENDB	BRGH	TRMT	TX9D	230

Legend: — = unimplemented, read as '0'. Shaded cells are not used for synchronous master reception.

* Page provides register information.

FIGURE 23-2: PICkit™ PROGRAMMER STYLE CONNECTOR INTERFACE



Pin Description*

1 = VPP/$\overline{\text{MCLR}}$

2 = VDD Target

3 = VSS (ground)

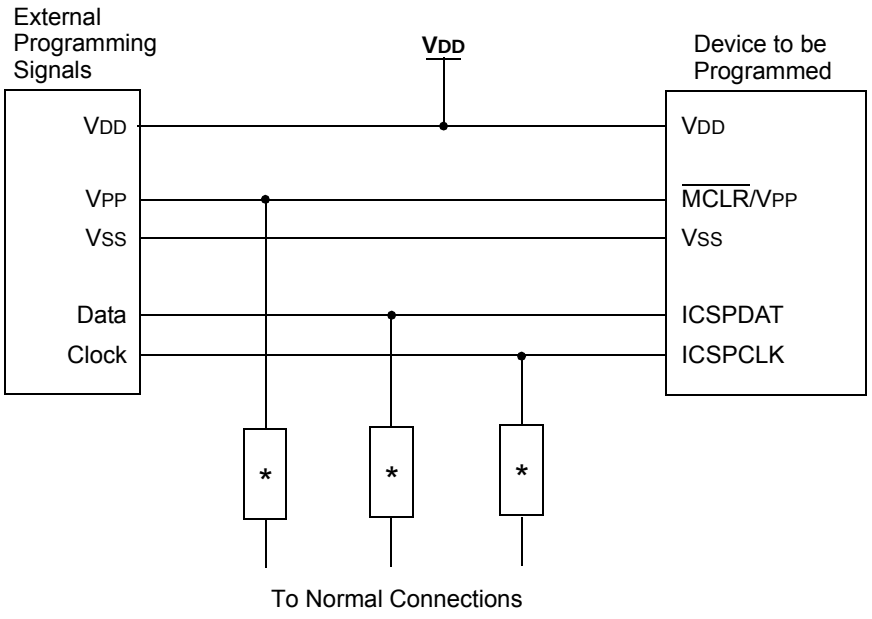
4 = ICSPDAT

5 = ICSPCLK

6 = No Connect

* The 6-pin header (0.100" spacing) accepts 0.025" square pins.

FIGURE 23-3: TYPICAL CONNECTION FOR ICSP™ PROGRAMMING



* Isolation devices (as required).

FIGURE 26-21: IDD, MFINTOSC MODE, FOSC = 500 kHz, PIC16LF1516/7/8/9 ONLY

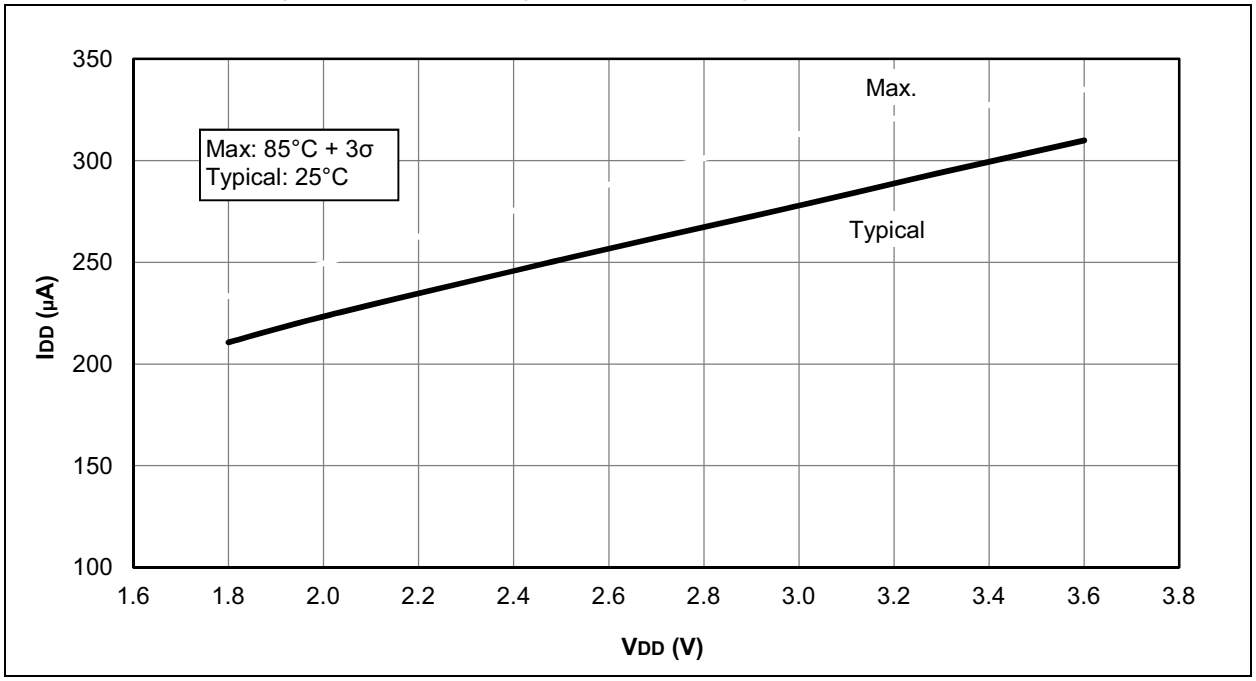


FIGURE 26-22: IDD, MFINTOSC MODE, FOSC = 500 kHz, PIC16F1516/7/8/9 ONLY

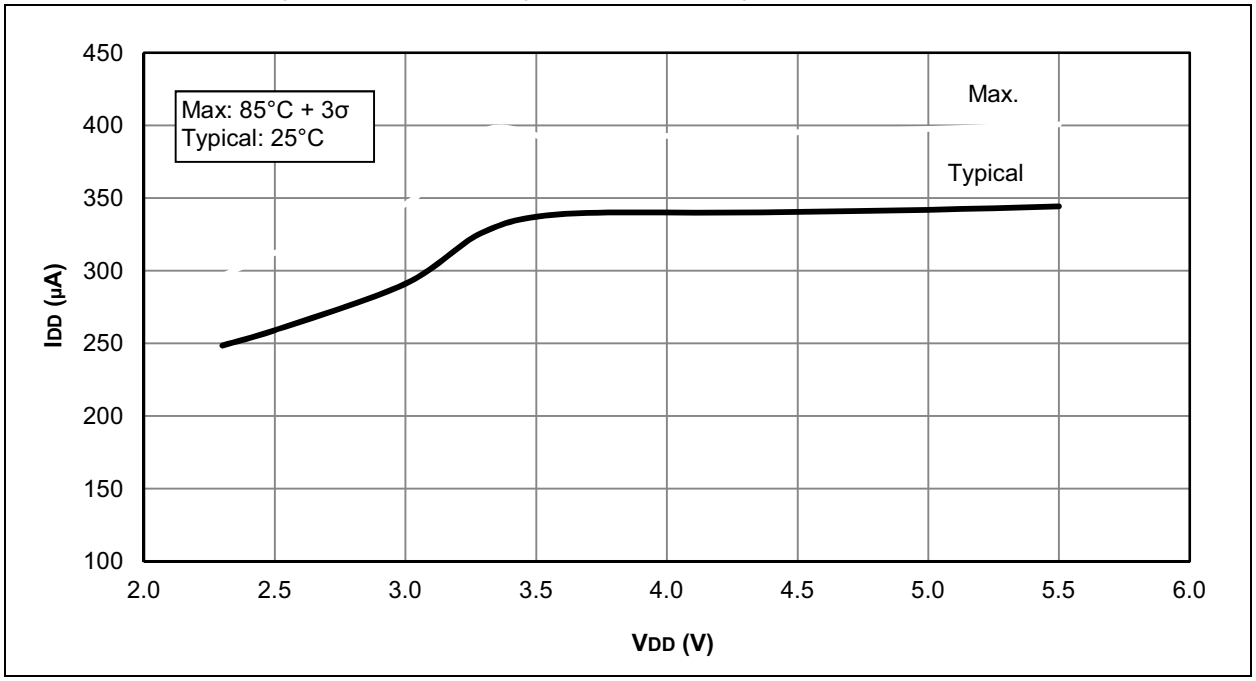


FIGURE 26-51: BROWN-OUT RESET VOLTAGE, BORV = 1, PIC16F1516/7/8/9 ONLY

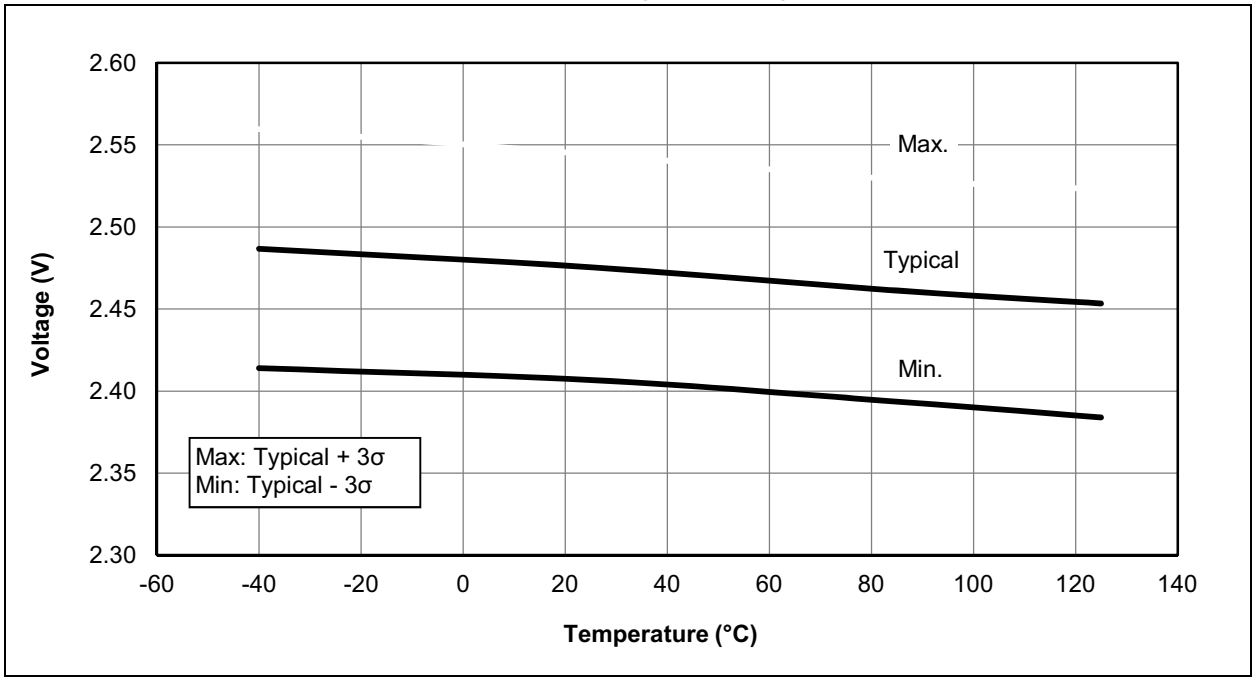


FIGURE 26-52: BROWN-OUT RESET HYSTERESIS, BORV = 1, PIC16F1516/7/8/9 ONLY

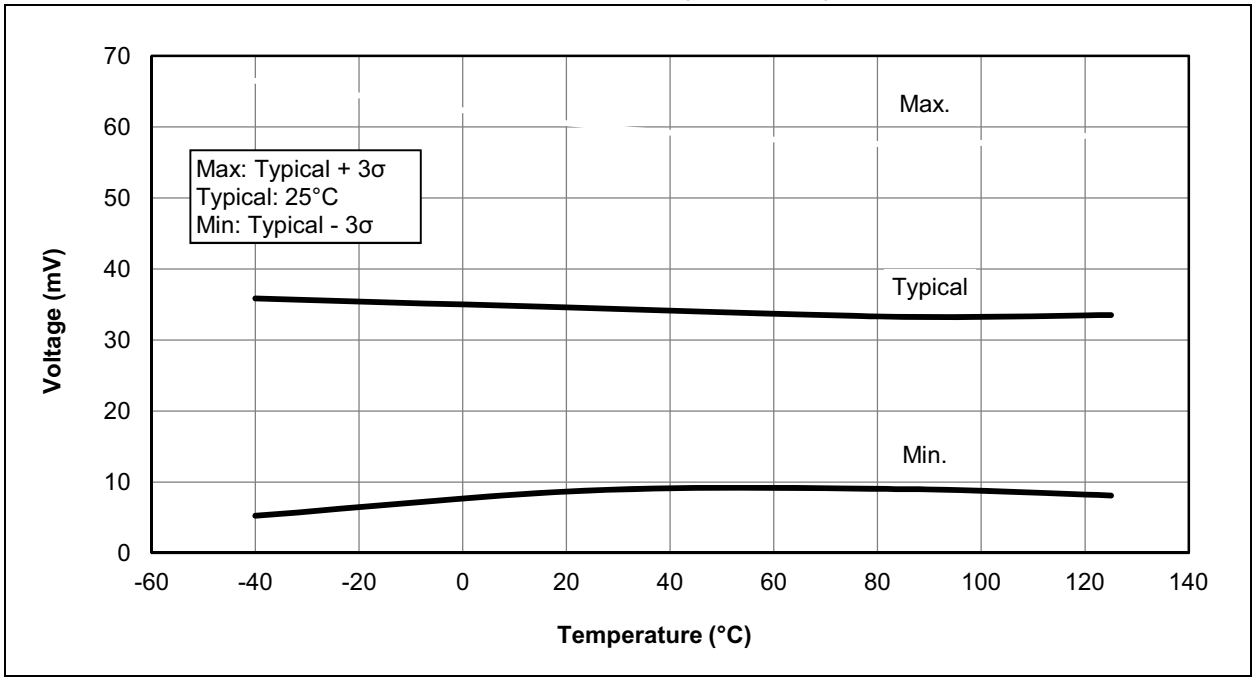
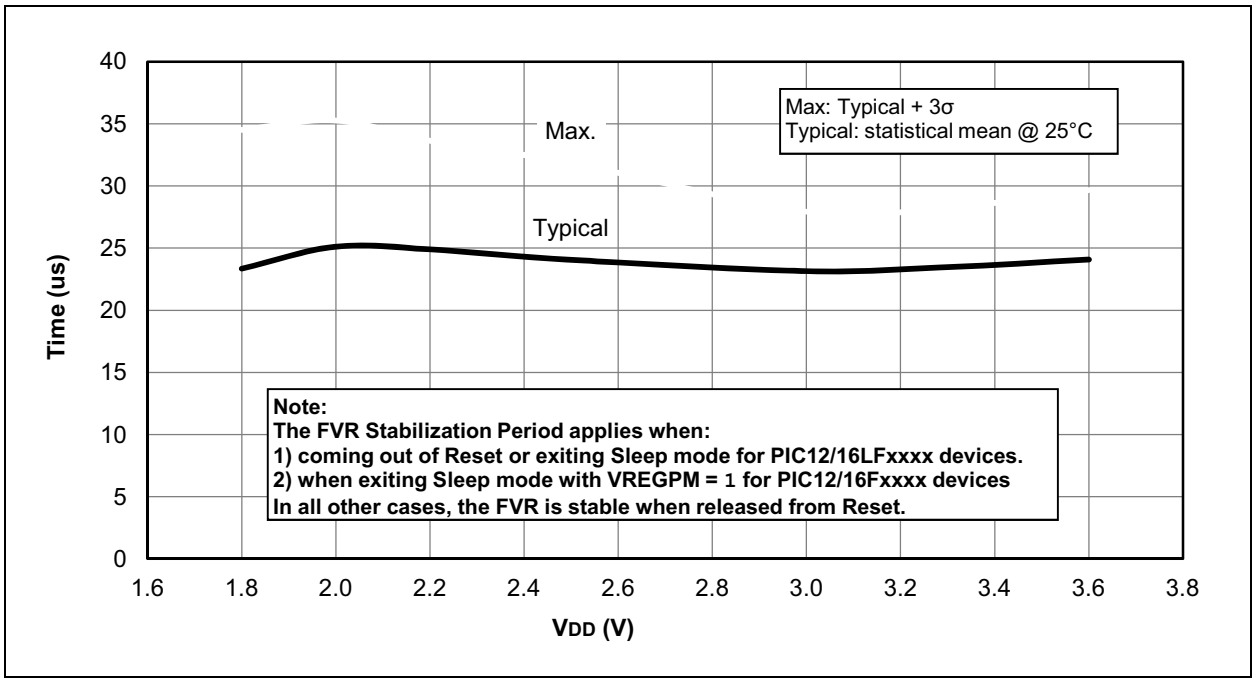
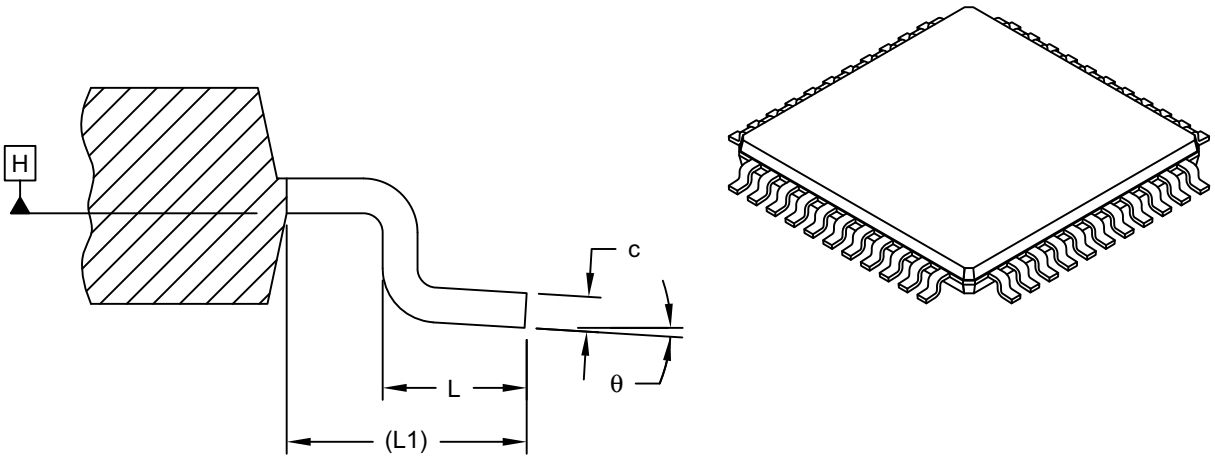


FIGURE 26-59: FVR STABILIZATION PERIOD



44-Lead Plastic Thin Quad Flatpack (PT) - 10x10x1.0 mm Body [TQFP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



SECTION A-A

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Leads	N		44	
Lead Pitch	e		0.80 BSC	
Overall Height	A	-	-	1.20
Standoff	A1	0.05	-	0.15
Molded Package Thickness	A2	0.95	1.00	1.05
Overall Width	E		12.00 BSC	
Molded Package Width	E1		10.00 BSC	
Overall Length	D		12.00 BSC	
Molded Package Length	D1		10.00 BSC	
Lead Width	b	0.30	0.37	0.45
Lead Thickness	c	0.09	-	0.20
Lead Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Foot Angle	θ	0°	3.5°	7°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Exact shape of each corner is optional.
3. Dimensioning and tolerancing per ASME Y14.5M

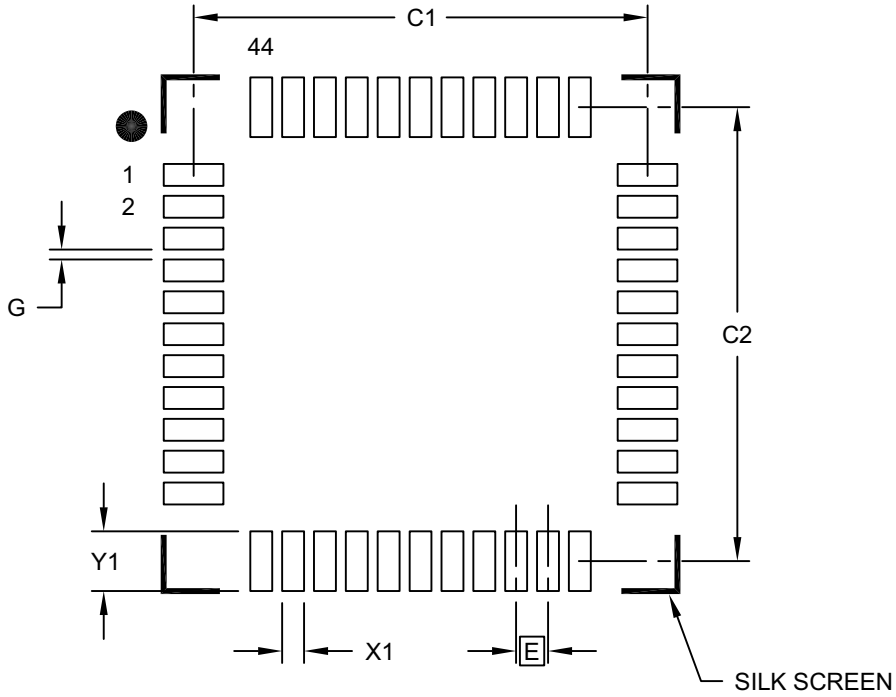
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-076C Sheet 2 of 2

44-Lead Plastic Thin Quad Flatpack (PT) - 10X10X1 mm Body, 2.00 mm Footprint [TQFP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.80 BSC		
Contact Pad Spacing	C1		11.40	
Contact Pad Spacing	C2		11.40	
Contact Pad Width (X44)	X1			0.55
Contact Pad Length (X44)	Y1			1.50
Distance Between Pads	G	0.25		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2076B